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flood hazard evaluation guidelines for federal executive agencies



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United States Water Resources Council

W. Don Maughan, Director

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FOREWORD

Executive Order 11296, issued in August 1966, expressed the concern of the Federal Government over mounting flood losses in the United States. It recognized that in order to be fully effective, programs for flood prevention or control must be combined with other management elements in a unified national program of floodplain management.

In order to provide equable treatment of flood hazard problems among Federal agencies, several Federal agencies established a work group to develop uniform guidelines and criteria for implementation of the Executive Order. The work group developed proposed guidelines and suggested that the Office of Management and Budget (then Bureau of the Budget) issue the guidelines to the affected Federal agencies.

While strongly endorsing issuance of the guidelines, the Office of Management and Budget stated that a more detailed review and coordination of the technical aspects of the guidelines was needed. The Water Resources Council, was requested by the Office of Management and Budget to review, revise where appropriate, and issue the guidelines developed by the work group.

The guidelines were reviewed and revised by the Council and published as "Proposed Flood Hazard Evaluation Guidelines", for Federal Executive Agencies in September 1969. Copies of the Guidelines were sent to 75 Federal Executive Agencies for testing through agency use. A report to the Council on the results of the tests was requested. The Guidelines were also sent to State agencies and to the Governors of the States through the Advisory Commission on Intergovernmental Relations. Useful comments were received from about 20 Federal agencies and 15 States during 1970.

Final revision of the Guidelines was subsequently begun and was influenced not only by the Federal and State comments received, but also by related work being simultaneously developed under the Water Resources Council auspices. The related work included "Regulation of Flood Hazard Areas to Reduce Flood Losses"--a 2 volume work published by the WRC in 1971-1972, and "A Unified National Program of Floodplain Management" expected to be published late in 1972.

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These Guidelines have been reviewed by member agencies of the Water Resources Council; were approved by the Council of Representatives on April 5, 1972, and are to be utilized by Federal Executive Agencies in complying with Executive Order 11296.

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FLOOD HAZARD EVALUATION GUIDELINES FOR FEDERAL EXECUTIVE AGENCIES

INTRODUCTION

Executive Order 11296 ^{1/} requires that the flood hazard be evaluated by all Federal executive agencies in the planning of new Federal facilities, in modifying existing Federal facilities or in constructing new ones, in disposing of Federal lands or properties, in carrying out programs involving land use planning, and in administering construction programs supported by Federal grants, loans, or mortgage insurance. The main objective is to reduce the risk of flood losses by implementing a broad Federal effort, directly and by example, to "...preclude the uneconomic, hazardous, or unnecessary use of flood plains..." along streams and coastal areas. Meeting that objective means, among other things, that if there are suitable non-floodplain sites available for a proposed development or use, then floodplain sites should be avoided unless they can be adequately protected within the development cost.

Issuance of the Executive Order is a recognition that the present upward trend of yearly flood losses in the Nation can be modified downward. This requires that decisions on whether to occupy a floodplain should more effectively take the flood hazard into account. The 1968 National Assessment of the Nation's water resources ^{2/}, prepared by the Water Resources Council, indicates that without such action the yearly national flood losses could be as high as 3-1/2 billion dollars by the year 2000. With such action, many of those losses can be prevented, and there can be a comparable prevention of human anguish and loss of life that ensues through injudicious occupancy of floodplains. These are considerable incentives for making the Executive Order fully effective.

Additionally, it should be recognized that floodplains have unique and significant public values, including wildlife habitat of recreational, aesthetic and scientific value, open space, and ground water recharge. The value of the floodplain as an environmental resource and the public benefits to be derived from it should be considered.

^{1/} Reproduced in Appendix A.

^{2/} "The Nation's Water Resources", for sale at \$4.25 per copy, by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Related Programs and Studies

Useful information on many of the subjects discussed in this document is found in the following publications, which describe programs and studies related to the objectives of the Executive Order.

"A Unified National Program for Managing Flood Losses", House Document 465, 89th Congress, 2nd Session. A report by the Task Force on Federal Flood Control Policy; August 1966.

Rules and Regulations of the National Flood Insurance Program. Copies of the rules and regulations can be obtained from the U.S. Department of Housing and Urban Development, Federal Insurance Administration, Washington, D.C. 20410.

"Regulation of Flood Hazard Areas to Reduce Flood Losses", a 2-volume work published by the Water Resources Council in 1971-1972. It contains legal aspects of, and draft legislation for, riverine and coastal floodplain regulation programs of States and local governments.

Purposes

The guidelines presented in this document have the primary purpose of assisting Federal executive agencies towards attaining equability in developing their own guidelines for the treatment of flood hazard problems when implementing Executive Order 11296.

The guidelines also provide agencies with basic policies and technical standards recommended for adoption when complying with Section 6 of the Executive Order, which states that each executive agency shall "...develop such procedures, regulations, and information as are provided for in, or may be necessary to carry out, the provisions of Sections 1, 2 and 3 of this order".

Application

These guidelines are to foster a commonality in procedures, regulations and information to be developed as appropriate, by executive agencies for a diversity of programs including Federal construction, assistance

programs, land disposals and land use planning. Federal Agencies having regulatory authority over land or property should evaluate the flood hazard in accordance with these guidelines and issue rules and regulations for development and use of the area.

Where regulatory authority is vested in State or local agencies, with regard to Federally financed or supported development, appropriate valuations of flood hazards may be accomplished by the user agency in conformance to these guidelines and procedures developed by the executive agencies for their programs.

FLOOD HAZARD AND ITS EVALUATION

Throughout this document, flood hazard is used as a general term meaning the risk to life or damage to property from overflows of the river or stream channel; extraordinary waves or tides occurring on lake, estuary, or ocean shores; flood flows in intermittent or normally dry streams; floods on tributary streams; floods caused by accumulated debris or ice in rivers; or other similar events.

Floodplains

Three general types of land area where flood hazard is common are riverine, coastal, and debris cone areas. At some locations there may be a combination of such areas, in which cases the hazard from all sources must be considered.

Riverine Floodplains are valley areas adjacent to a stream or river (see figure 1). A flood on such an area is due to a rainstorm or snowmelt runoff that exceeds the carrying capacity of the low flow or main channel of the valley, or which is due to channel obstructions that cause even relatively small flows to overflow channel banks. Riverine areas common to both a tributary and a main channel may be flooded by either the tributary or the main channel or by both simultaneously.

Coastal Floodplains are areas bordering a lake, estuary, ocean, or similar body of standing water (see figure 2). Floods are due to landward flows caused by excessively high tides, waves from high winds,

surges from distant storms, tsunamis (large waves produced by subterranean earth movements at sea), or by combination of these causes. Especially along freshwater shores, damage is also caused by ice driven ashore by wind or wave action.

Debris Cone Floodplains are areas along the bases of mountains that developed by deposition of debris carried by flows from the mountain streams (see figure 3). Debris cones are also called alluvial cones, alluvial fans, debris slopes, or talus. Due to the manner of its development, a debris cone often has a somewhat semi-circular appearance when seen from above, and has slopes steeper than the land on which it is formed but less steep than the bed of the stream that is the source of the floodwater, sediment, and debris. Under natural conditions, there is no permanent low-flow or main channel, and the path of the next flood flow down the cone is unpredictable. Floods are due to rainstorm or snowmelt runoffs, or to subsurface return flows (rain or snow that soaks into the soil and travels underground to a spring or stream) of the stream that developed the cone. Debris cones are sometimes so flat as to be almost indistinguishable from riverine areas.

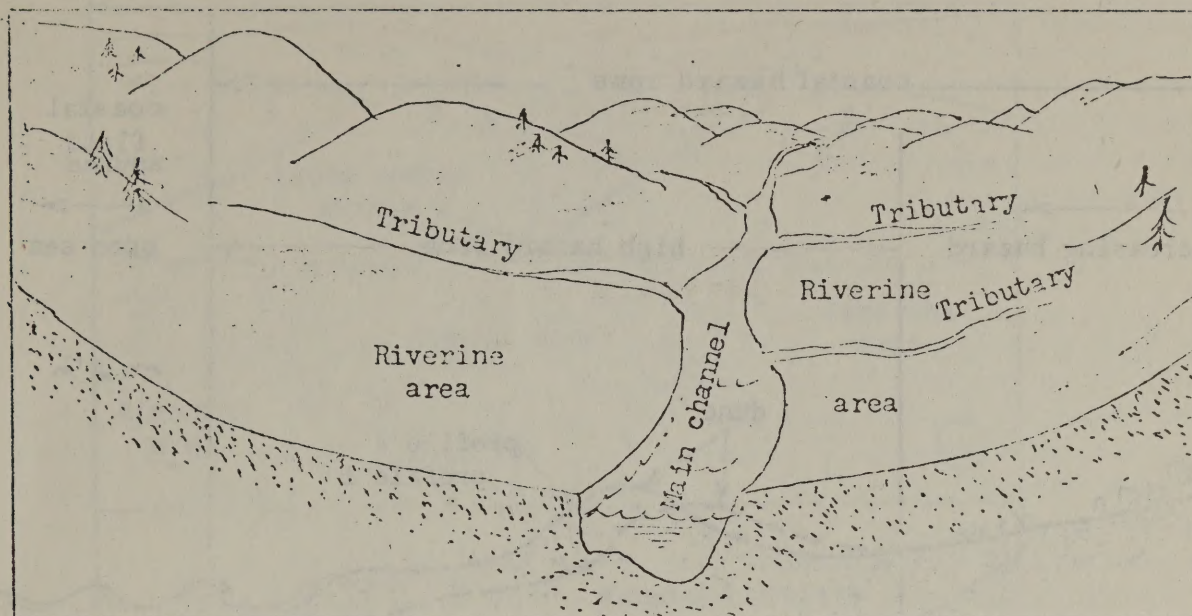


FIGURE 1. --Sketch, not to scale, of a typical riverine area representing either a large river valley or a small stream in the uplands. With residential, municipal, and industrial structures superimposed, the sketch would represent a city on a river or an urban community in uplands. The flood source is either the main channel or a tributary or on occasion both.

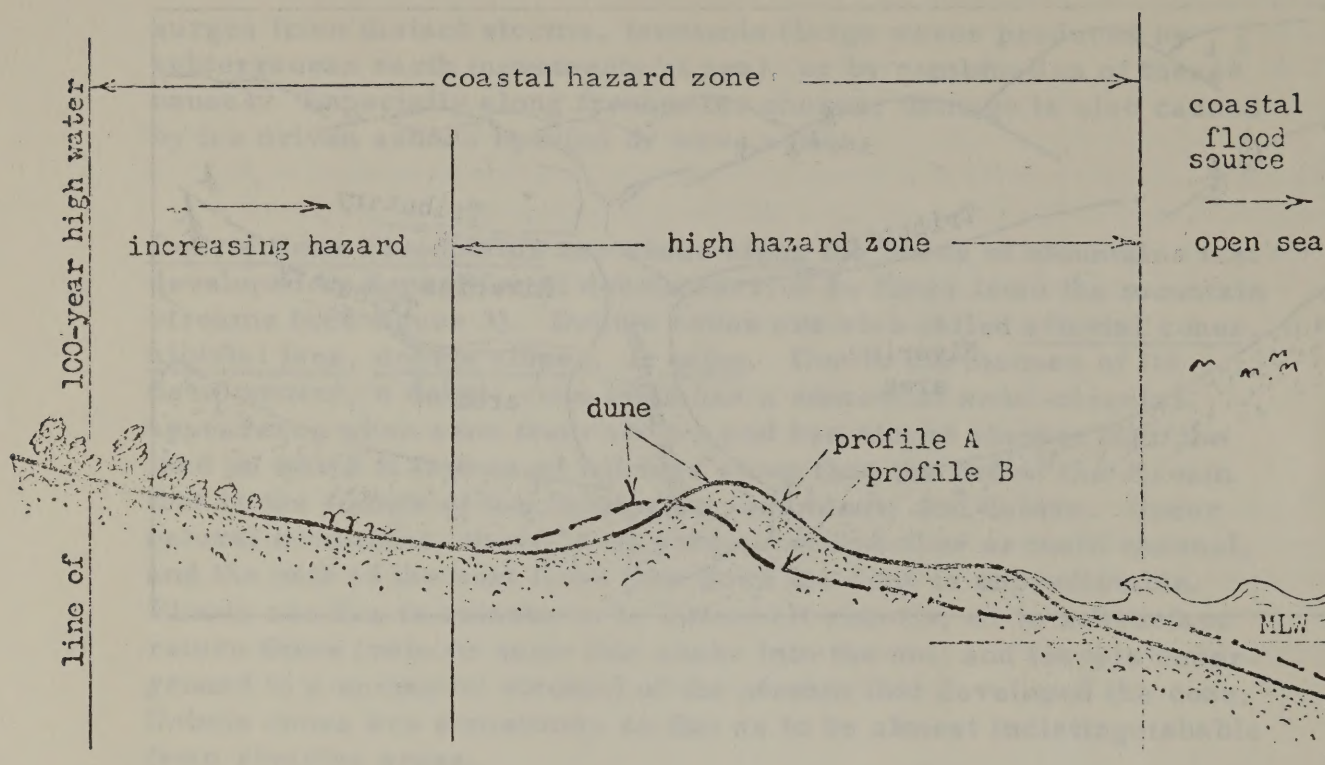


FIGURE 2. --Profiles, not to scale, of a typical erosive hazard zone of a seacoast. Profile A is the summer and B the winter profile. For this particular shore, the profiles vary not only from season to season but also from the occurrence of great storms at sea. Thus, the profiles shown are not the extremes that may exist. Coastal areas with rock shores or cliffs will have different and more stable profiles.

Near the 100-year high water frequency line there is vegetation of a relatively permanent kind; near and on the dune the vegetation is temporary unless special means are taken to make it less so.

The open sea may be occupied at various locations by fishing piers, docks, etc., and also by engineering works such as groins or breakwaters. The high hazard zone is where the summer activity occurs (swimming, surfing, beach use, etc.). Such zones can be made somewhat more safely inhabitable by the use of deep piling for structural foundations, with the structures themselves well above high water. Landward of that zone are restaurants, habitations, etc., with relative safety and permanence increasing further landward.

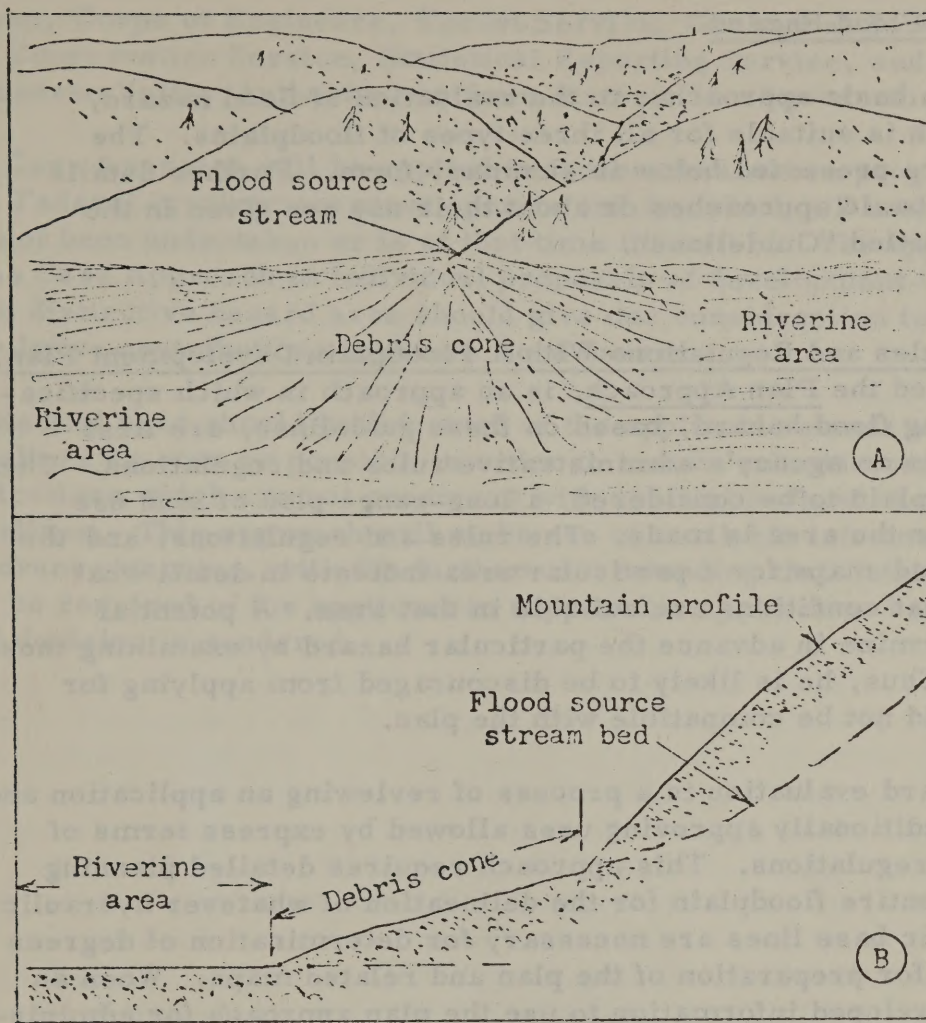


FIGURE 3. --Sketches, not to scale, of (A) perspective view of a debris cone and (B) profile of cone area.

Ordinarily, inhabitation or development begins near the toe of the cone and progresses upward on the cone until halted by a large flood; or, if mainly agricultural, development begins for the sake of the water near where the stream leaves the mountain, with habitations located where flood flows are hopefully not expected.

Evaluation of Flood Hazard

There are two basic approaches to the evaluation of flood hazard, either of which is suitable for all three types of floodplains. The approaches are presented below in summary form. Further details about the two basic approaches or about their use are given in the later section titled "Guidelines".

The Use of Rules and Regulations With A Floodplain Development Plan, hereafter called the Plan Approach, is an approach in which specifications regarding flood hazard, based on these guidelines, are first incorporated in an agency's administrative rules and regulations. Then, for each floodplain to be considered, a long-range plan of land use regulations for the area is made. The rules and regulations, and the plan and related maps for a particular area indicate in detail what uses under what conditions are suitable in that area. A potential user can determine in advance the particular hazard by examining those documents. Thus, he is likely to be discouraged from applying for uses that would not be compatible with the plan.

The flood hazard evaluation is a process of reviewing an application and of fully or conditionally approving uses allowed by express terms of the rules and regulations. This approach requires detailed planning studies of an entire floodplain for the delineation of whatever hydraulic and topographic base lines are necessary for determination of degrees of hazard and for preparation of the plan and related maps. When an agency has developed information to use the plan approach for administering E.O. 11296 a copy of the plan should be furnished to other concerned agencies and to the community.

The Use of General Standards for Application to Case-by-Case Development, hereafter called the Case Approach, is an approach in which an agency first adopts general standards, based on these guidelines, and subsequently determines on a case-by-case basis the suitability of a proposed use in a particular floodplain.

Suitable photographs, topographic maps, floodplain information reports, soils maps, or other maps useful in the Case Approach may be available from Federal agencies such as the Agricultural Stabilization & Conservation Service, Army Map Service, Bureau of Land Management, Bureau of Outdoor Recreation, Bureau of Reclamation, National Ocean

Survey, Corps of Engineers, Forest Service, Geological Survey, Soil Conservation Service, Statistical Reporting Service, and the Tennessee Valley Authority, or from State or local government offices.

The Case Approach will be applied in those areas where programs with Federal involvement must operate and for which a Plan Approach has not been undertaken or is at that time infeasible. The application of the Case Approach to individual proposals of development in the same distinctive hazard area should give due consideration to their cumulative contributions to future flood hazard.

A potential user should be informed of the applicable standards and guidelines as soon as possible in order to reduce submissions of applications which are not consonant with applicable flood hazard guidelines. This approach will make use of available information as an advance warning, with the further understanding that detailed studies may be required of the applicant to support his application before a final decision is rendered.

GUIDELINES

The guidelines with explanatory notes after each one where appropriate are numbered for reference, in about the same order as the problems that arise in preparing for and making a flood hazard evaluation. However, it is best to consider all of the guidelines before following any one of them.

In carrying out their responsibilities under Executive Order 11296, the Federal Executive Agencies should:

(1).....DETERMINE FIRST, WHEN A PROPOSED USE IS EXAMINED, WHETHER THERE IS ANY NEED TO EVALUATE THE FLOOD HAZARD AT THE SITE OR STRUCTURE LOCATION BEING CONSIDERED.

Essentially, this means no more than deciding whether the site or structure may be in a floodplain. Using the Plan Approach, the agency will already have official maps for the area, so that the decision can be made immediately. Using the Case Approach, the agency either makes a brief preliminary investigation (has its experts obtain and examine maps of the area or visit the area) or requests the information from one of the agencies named in Section 3 of the Executive Order, or other appropriate source, before making the decision. If it is decided by the concerned agency that there is a need to evaluate the flood hazard, then the remaining guidelines apply as appropriate.

(2).....CONSIDER BOTH THE "PLAN" AND THE "CASE" APPROACHES FOR A FLOODPLAIN ABOUT TO RECEIVE A FLOOD HAZARD EVALUATION, AND SPECIFY THE CONDITIONS UNDER WHICH ONE OR THE OTHER OF THE APPROACHES IS MORE APPROPRIATE.

The "Plan" and "Case" approaches are described previously in the section title "Evaluation of Flood Hazard".

Before adopting either approach for a particular area, the agency should learn what flood evaluation information is already available, which means not only what Federal agencies may have on hand but

also what State and local governmental agencies may have in their statutes, regulations, ordinances, maps, etc., by going into investigation of data sources further than was done under Guideline 1.

Also, before adopting either approach, the agency should consider its own resources and whether it would be better to make its own evaluation, or whether assistance should be requested from one of the agencies named in Section 3 of Executive Order 11296 or other appropriate source.

(3).....USE THE FOLLOWING TO IDENTIFY AND EVALUATE THE FLOOD HAZARD:

(3A.).....THE 100-YEAR FLOOD AS THE BASIC FLOOD:

(3B.).....THE FLOOD HAZARD ZONE, DEFINED AS THE AREA INUNDATED BY THE BASIC FLOOD:

(3C 1).....IN THE PLAN APPROACH A FLOODWAY, DEFINED AS THE PORTION OF A RIVERINE FLOODPLAIN NEEDED TO CONVEY A BASIC FLOOD, WITH NOT MORE THAN ONE FOOT RISE IN FLOODWATER ELEVATION; OR

(3C 2).....IN THE CASE APPROACH A PROCEDURE TO ASSURE THAT ANY ENCROACHMENT ON THE FLOODPLAIN WILL PERMIT CONVEYANCE OF THE BASIC FLOOD WITHOUT INCREASING FLOOD HEIGHTS OR VELOCITIES TO AN EXTENT WHICH WOULD CAUSE SIGNIFICANT UPSTREAM OR DOWNSTREAM DAMAGE TO EXISTING OR REASONABLY ANTICIPATED FUTURE DEVELOPMENT.

(3D.).....FLOODS GREATER OR LESS THAN THE BASIC FLOOD AS APPROPRIATE.

Basic Flood. The 100-year flood has a magnitude that may be equaled or exceeded once every hundred years, on the average. It is also called the 100-year frequency flood, or the 1 percent chance flood (it has 1 chance in 100 of being equaled or exceeded in any given year), or else it is said to have a 100-year recurrence interval. Other floods having a designated frequency should be similarly treated. In all cases, all of the conditions affecting flows should be a part of the

frequency analysis in determining elevations. The 100-year and other frequency floods are determined by a flood frequency analysis, when flood data are available, as described for riverine flooding in the Water Resources Council's Bulletin 15, "A Uniform Technique for Determining Flood Flow Frequencies". The procedure has been approved and adopted by the Council for use by all Federal agencies in all riverine planning involving water and related land resources. When flood data are inadequate or unavailable, the regional analysis or hydrometeorological method of determining flood magnitude for a given frequency is estimated using flood records from nearby areas. Details of typical methods of regional analysis are given in "Generalization of Streamflow Characteristics", by Thomas and Benson; U.S. Geological Survey, Water Supply Paper 1975; and in "Statistical Methods in Hydrology", by L. R. Beard; U.S. Corps of Engineers. Either the Geological Survey or the Corps of Engineers can furnish information as to whether regional analyses have already been made in order to prevent unnecessary duplication of effort. The Soil Conservation Service can also furnish information on the hydrometeorological method.

Regulatory Principle. In the consideration of the area required to convey the basic flood utilize the Regulatory Principle that all parts of the riverine floodplain are not alike in conveying flood flows, and that the effect of some marginal or other encroachments on the floodplain may be insignificant.

As used for regulatory purposes in the Plan Approach and where floodways have been delineated, the floodway is that portion of the floodplain required to pass a regulatory flood, which equates to a basic flood, with no significant increase in the profile due to marginal confinement or impedance of flow. It is delineated within a framework of assumptions that include the passage of a large flood, such as the basic flood, with the constraint that assumed land filling from the margins of the floodplain would not increase flood heights at any point on the flood profile by a significant amount. A significant amount is generally taken as falling within the range of zero to 1 foot.

In the Case Approach and in the absence of a delineated floodway, which will be the usual case in the near future, the Regulatory Principle should be utilized.

Coastal margins, similarly, should exclude buildings in the areas subject to major wave attack and erosional change which accompany overflow.

Floodway Fringe. The area outside the floodway but still in the flood hazard zone is usually called the "floodway fringe". Developments are permitted providing their elevations where flood damage begins are not below a specified level (See Guideline 11 for an example).

Great Floods. Floods exceeding the 100-year flood have occurred in many areas of the United States. No part of the country is immune from such occurrences, and it has become a standard practice of agencies dealing with flood problems to use a flood greater than the 100-year to indicate what can occur at different locations in a floodplain. The Corps of Engineers in its floodplain information reports uses a "Standard Project Flood" or, for coastal areas, a "Standard Project Hurricane", to show flood depths, greater than the 100-year depths, that could be experienced. The Tennessee Valley Authority uses a "Maximum Probable Flood" in a similar manner in its area of operations, and the Soil Conservation Service uses a similar large magnitude flood in its flood hazard analyses. Inasmuch as floods of this large size are seldom given any particular frequency, they will be referred to as floodplain floods in the guidelines.

(4).....DETERMINE WHETHER THERE ARE EXISTING LAWS OR STATUTES OF THE FEDERAL GOVERNMENT, RULES OR REGULATIONS OF OTHER FEDERAL AGENCIES, OR LAWS, STATUTES, ORDINANCES, ETC., OF STATE OR LOCAL GOVERNMENTS THAT PROVIDE STANDARDS FOR REGULATION OF THE FLOODPLAIN UNDER STUDY. IN CASES WHERE THOSE STANDARDS ARE EITHER MORE STRINGENT THAN THOSE BASED ON THESE GUIDELINES, OR ARE APPLICABLE TO SITUATIONS OR CONDITIONS NOT COVERED BY THESE GUIDELINES, THEY SHOULD BE CONSIDERED FOR THE EVALUATION OF FLOOD HAZARD IN THAT AREA.

By "more stringent" is meant a standard that is more severe or restrictive in order to provide greater safety or to reduce flood hazard more effectively. Federal agencies should support the States and local governments to make their rules, regulations, standards etc. fully effective.

An exception to this guideline involves Federal property listed on the National Register of Historic Places. Such property should not be demolished, modified, or disposed of without first affording the U.S. Advisory Council on Historic Preservation an opportunity to comment on the undertaking; nor should Federal assistance be denied to registered historic places by reason only of their location in a flood hazard zone. The Historic Sites Act of 1935 (Public Law 74-292) and the National Historic Preservation Act of 1966 (Public Law 89-665) provide directives and guidance in these matters.

(5).....DECIDE ON THE CONDITIONS UNDER WHICH AN EVALUATION MUST BE MADE TO DETERMINE THE IMPACTS OF INCLUDING OR EXCLUDING THE USE OF SITE IN A FLOODPLAIN. SUCH EVALUATION MUST DEMONSTRATE CLEARLY THAT THE USE OF THE SITE IS TO THE ADVANTAGE OF SOCIETY AS WELL AS TO THE ADVANTAGE OF THE USER OF SUCH SITE.

The evaluation mentioned in this guideline may be based on an analysis of the beneficial and adverse social, economic, and environmental effects of proposed development in the floodplain as an alternative to the same development outside the floodplain. Economic benefits are not by themselves, sufficient basis for development in the floodplain. It must also be demonstrated that the beneficial effects are of such magnitude and importance to the community as to offset the adverse effects. The standards used in these evaluations will be those specified by the Water Resources Council for planning for water and related land resources.

(6).....SELECT THE FLOODS TO BE USED IN A FLOOD HAZARD EVALUATION TO FIT CONDITIONS OF THE AREA BEING INVESTIGATED.

The floods that need to be considered before selecting the evaluation floods are the 100-year flood (discussed under Guideline 3), the floodplain flood discussed under Guideline 3, the regulatory floods used by States or local governments, and lesser floods such as the 25 and 50-year floods, which are of use in evaluations when those floods' elevations would extend outside the floodway.

With the Plan Approach, official maps of a particular floodplain should show land elevations and also the boundaries of the basic and possibly other frequency floods.

The Case Approach, requires considerable field and office work, but there are ways in which the work can be simplified. This is especially true if flood determinations were made previously for upstream or downstream sites in the vicinity. Agencies named in Section 3 of Executive Order 11296 should be consulted on these matters. There is also the possibility that the site under consideration is in an area studied by the Corps of Engineers, Geological Survey, Soil Conservation Service, Tennessee Valley Authority, or by a State or local water resource agency. If it is, then maps in the study report may give site elevations, and elevations of the 100-year and flood-plain floods. If elevations of lesser floods are needed, they may be determined from information in the report text or obtained from the office that carried out the study.

In a location where a State or local government has established regulations for floodplain use, the Federal agency making the flood hazard evaluation should consider the provisions of those regulations if they are more restrictive than provisions suggested by these guidelines.

(7).....USE, AS THE MINIMUM AMOUNT OF INFORMATION FOR AN EVALUATION OF FLOOD HAZARD, THE ELEVATION OF THE LOWEST POINT OF WATER ENTRY (TAKING SEEPAGE UNDER FLOOD CONDITIONS INTO ACCOUNT, IF NECESSARY) AT THE SITE OR STRUCTURE BEING EVALUATED, THE ELEVATIONS OF THE APPLICABLE FLOODS AT THE LOCATIONS OF THE SITE OR STRUCTURE, AND THE INTENDED USE OF THE SITE OR STRUCTURE AND ITS CONTENTS.

The lowest point of water entry of a structure may be at the elevation of a basement drain outlet, rather than at a basement window, or it may be at the lowest level of seepage through a foundation during prolonged flooding.

When the "applicable floods" are selected, as discussed in Guideline 6, their elevations will be known. The elevations and the intended use of the site or structure, and the structure contents, will be provided by the applicant.

(8).....USE, AS SUPPLEMENTARY INFORMATION FOR AN EVALUATION OF FLOOD HAZARD, THE PRESENT AND PROPOSED MEANS OF FLOOD WARNING, AVAILABLE MEANS OF ESCAPE FROM FLOODS, AND THE TYPES OF STRUCTURES FOR PERMANENT OR TEMPORARY OCCUPANCY, WHICHEVER ARE APPLICABLE.

For information on flood warnings, see: "Floods and Flood Warnings", NOAA (ESSA) Pamphlet No. P1 660025, dated 1969; Flood Warning Benefit Evaluation--Susquehanna River Basin (Urban Residences), U.S. Department of Commerce, NOAA, National Weather Service, Techn. Memo. WBTM HYDRO 10, March 1970; and "A Model Hurricane Plan for a Coastal Community", NOAA, National Weather Service, July 1966.

The location and evaluation of means of escape from floods is made through use of detailed maps showing roads and other facilities of the area.

(9).....CONSIDER THE EFFECTS OF FLOOD-PROOFING ON THE REDUCTION OF FLOOD HAZARD.

Floodproofing of a permanent nature (at least as permanent as the structures or facility to which it is applied) will justify a more intensive use at a location where such a use would ordinarily not be permitted. The effect of floodproofing is to increase the elevation of the lowest point of water entry (see Guideline 7), so that flood hazard is reduced. Types of floodproofing are described in "Introduction to Flood Proofing" by John R. Sheaffer; The Center for Urban Studies, University of Chicago; April 1967.

(10).....DETERMINE THE EFFECTS OF PROPOSED HIGHWAY CONSTRUCTION IN THE FLOODPLAIN AND ITS VICINITY, AND OF PROPOSED UPSTREAM OR LOCAL FLOOD PREVENTION OR CONTROL MEASURES, IF ANY, ON THE ELEVATIONS OF THE EVALUATION FLOODS.

Hydrologic expertise is needed for these determinations, but not necessarily within the agency making the hazard evaluation.

The Federal Highway Administration, in its implementation of Executive Order 11296, has issued Memorandum 20-1-67 (32-44) concerning evaluation of flood hazard for Federally financed highways.

In part, the memorandum reads as follows:

"In planning the location of a highway, serious consideration should be given to locations that avoid areas subject to flooding. If an encroachment of a floodplain is necessary, an evaluation should be made of the flood potential, the effect of the flood potential on the highway, and the effect of the highway construction on the flood hazard. Such evaluations should assure that any highway structure, roadway embankment, or bridge, that encroaches on or crosses the floodplain of a drainage course will not cause a significant adverse effect to developments in the floodplain and will be capable of withstanding the flood flow with minimum damage".

The Federal Highway Administration requires that the State Highway Departments make (or cause to be made) the flood hazard evaluation. Thus, inquiries regarding the effects of proposed highways should be made of those Departments.

The effects of existing or proposed upstream or local flood prevention or control measures will generally be learned from the agency or organization responsible for such measures and will be used in conjunction with Guideline 13.

If information on the effects of proposed highways or protective measures is nowhere available, the agencies mentioned in Section 3 of Executive Order 11296 may be able to provide assistance in determining the effects.

(11).....MAKE THE EVALUATION OF FLOOD HAZARD FOR THE SITE OR STRUCTURE, USING INFORMATION COMPILED UNDER THE PRECEDING GUIDELINES, AND DECIDE WHETHER THE PROPOSED USE IS SUITABLE AT THE PROPOSED LOCATION AND, IF SO, UNDER WHAT CONDITIONS.

If the impact analysis mentioned in Guideline 5 has been made, that analysis will provide the information needed for a decision about a proposed use.

If such an analysis is not made, the evaluation and decision are based on the information compiled under the preceding guidelines. This information, at a minimum, will be the site or structure and flood elevations mentioned in Guideline 7 but the evaluation will be improved by also having on hand the information compiled for Guidelines 8, 9, and 10. Whether using the Plan Approach or the Case Approach, the decisions are more readily made if uses, or classes of uses, are tabulated in order of degree of protection required or inversely, the maximum flood hazard permitted under the agency's policy. Guides to degrees of protection for differing classes and uses of land and facilities are given in the following tabulation:

<u>Uses or Facilities</u>	<u>Degree of Protection Required</u>	<u>Permissible Location & Lowest Water-Entry Elevation</u>
Buildings containing valuable documents or data or instruments, or materials dangerous to the public if released by flooding; power installations needed in emergencies; hospitals and like institutions; etc.	Maximum	Outside the Area of Floodplain floods.
Residential buildings whose occupants may not have adequate warning or means of escape during floods; public service installations needing high protection; permanent memorial cemeteries; etc.	High	Not below the elevation of the 100-year flood, and not in a riverine floodway.
Buildings with salvageable or replaceable goods or for storage of readily moved goods; low-cost service shops; etc.	Moderate	Not below the elevation of the 50-year flood, and not in a riverine floodway.
Open-air markets or theaters or facilities storing low-cost, non-dangerous materials; etc.	Low	Not below the elevation of the 25-year flood, and not in a Riverine Floodway.

<u>Uses or Facilities</u>	<u>Degree of Protection Required</u>	<u>Permissible Location & Lowest Water-Entry Elevation</u>
Low-value crop or pasture land, picnic grounds, fishing piers, recreation and wild-life use, etc.	Minimum	

For a debris cone area, such a tabulation will require use of a parameter other than flood elevation alone to indicate degree of protection. Distance from the flood source may be a more useable parameter; structural elevation above normal ground level may be another.

With a tabulation of permitted uses and the information from Guidelines 7 through 10, it will be possible to make the hazard evaluation and the decision regarding the proposed use and location. It should also, be decided whether the applicant must meet certain conditions, such as installing floodproofing, or whether restrictions on the use are needed.

(12).....ADOPT THE POLICY OF DISCOURAGING THE CONSTRUCTION OF THOSE ROADS, UTILITIES, AND OTHER PUBLIC FACILITIES (EXCEPT THOSE CROSSING STREAMS) WITHIN THE MOST HAZARDOUS PORTIONS OF THE FLOODPLAIN THAT AGGRAVATE FLOODING AND ENCOURAGE UNDESIRABLE DEVELOPMENTS IN THAT ZONE.

In general, the higher hazard is in the area between the flood source and about the limit of flooding in a 25-year flood. There is hazard above that level, of course, but excluding all roads, utilities, and other public facilities throughout a floodplain appears to be desirable only if that area is to be retained in its natural state. The floodway, of course, should be kept free of significant flow obstructions.

(13).....DEVELOP, IN CONJUNCTION WITH LOCAL "PERMIT AGENCIES" A LIST OF FACILITIES AND USES THAT WOULD BE PERMITTED IN PRESENT FLOODPLAINS BEFORE AND AFTER COMPLETION OF UPSTREAM OR LOCAL FLOOD PREVENTION OR CONTROL MEASURES SO AS TO ENSURE THAT CONSTRUCTION OR OCCUPANCY DOES NOT OCCUR BEFORE THE MEASURES ARE EFFECTIVE.

"Permit agencies" are State or local government agencies that may have laws, statutes, or ordinances under which the agencies issue permits for, or otherwise regulate, use of floodplains. The public should know about and have ready access to such "Permit agencies".

(14).....DELINEATE, OR ENSURE THE DELINEATION OF, ON FEDERALLY OWNED PROPERTIES, THE ELEVATION OF THE 100-YEAR FLOOD, AND THE ELEVATIONS AND DATES OF OCCURRENCE OF FLOODS OF RECORD WHOSE MAGNITUDES SHOULD BE KNOWN BY THE PUBLIC.

With the Plan Approach, such delineations can be made once the official uses and the flood elevations are known. With the Case Approach, the work will usually be piecemeal and the lack of delineations may encourage the submission of applications for unsuitable uses in the area.

(15).....ENCOURAGE STATE AND LOCAL AGENCIES TO KEEP A PERMANENT RECORD OF INFORMATION ON EACH FLOOD PLAIN EVALUATED, THE FLOOD HAZARD EVALUATION PROCEDURES AND DECISIONS, THE FLOOD PREVENTION OR CONTROL MEASURES PROPOSED FOR UPSTREAM OR LOCAL CONSTRUCTION, THE FLOOD ELEVATION DELINEATIONS, THE USES THAT ARE SUITABLE AND THE ORDER OR SCHEDULE OF ESTABLISHMENT OF SUITABLE FACILITIES, THE SATISFACTORY HUMAN AND ANIMAL OCCUPANCY AND THE GENERAL STANDARDS APPLICABLE TO RECOMMENDED OR APPROVED USES OF THE FLOOD HAZARD AREA. WHERE FLOODPLAIN REGULATION BY LOCAL "PERMIT AGENCIES" OR DIRECT FEDERAL REGULATION IS MADE A CONDITION OF USE OR OCCUPANCY, OR WHERE GUARANTEES FROM USERS WHOSE PERMISSION TO BUILD OR OCCUPY IS CONTINGENT ON THEIR PERFORMANCE OF SPECIFIED ACTIONS, FORMAL GUARANTEES OR AGREEMENTS AND OTHER DECISIONS REACHED FOR THE AREA SHOULD BE A MATTER OF PERMANENT RECORD.

Presidential Documents

Title 3—THE PRESIDENT

Executive Order 11296

EVALUATION OF FLOOD HAZARD IN LOCATING FEDERALLY OWNED OR FINANCED BUILDINGS, ROADS, AND OTHER FACILITIES, AND IN DISPOSING OF FEDERAL LANDS AND PROPERTIES

WHEREAS uneconomic uses of the Nation's flood plains are occurring and potential flood losses are increasing despite substantial efforts to control floods; and

WHEREAS national and regional studies of areas and property subject to flooding indicate a further increase in flood damage potential and flood losses, even with continuing investment in flood protection structures; and

WHEREAS the Federal Government has extensive and continuing programs for the construction of buildings, roads, and other facilities and annually disposes of thousands of acres of Federal lands in flood hazard areas, all of which activities significantly influence patterns of commercial, residential, and industrial development; and

WHEREAS the availability of Federal loans and mortgage insurance and land use planning programs are determining factors in the utilization of lands:

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

SECTION 1. The heads of the executive agencies shall provide leadership in encouraging a broad and unified effort to prevent uneconomic uses and development of the Nation's flood plains and, in particular, to lessen the risk of flood losses in connection with Federal lands and installations and federally financed or supported improvements. Specifically:

(1) All executive agencies directly responsible for the construction of Federal buildings, structures, roads, or other facilities shall evaluate flood hazards when planning the location of new facilities and, as far as practicable, shall preclude the uneconomic, hazardous, or unnecessary use of flood plains in connection with such facilities. With respect to existing Federally owned properties which have suffered flood damage or which may be subject thereto, the responsible agency head shall require conspicuous delineation of past and probable flood heights so as to assist in creating public awareness of and knowledge about flood hazards. Whenever practical and economically feasible, flood proofing measures shall be applied to existing facilities in order to reduce flood damage potential.

(2) All executive agencies responsible for the administration of Federal grant, loan, or mortgage insurance programs involving the construction of buildings, structures, roads, or other facilities shall evaluate flood hazards in connection with such facilities and, in order to minimize the exposure of facilities to potential flood damage and the need for future Federal expenditures for flood protection and flood disaster relief, shall, as far as practicable, preclude the uneconomic, hazardous, or unnecessary use of flood plains in such connection.

THE PRESIDENT

(3) All executive agencies responsible for the disposal of Federal lands or properties shall evaluate flood hazards in connection with lands or properties proposed for disposal to non-Federal public instrumentalities or private interests and, as may be desirable in order to minimize future Federal expenditures for flood protection and flood disaster relief and as far as practicable, shall attach appropriate restrictions with respect to uses of the lands or properties by the purchaser and his successors and may withhold such lands or properties from disposal. In carrying out this paragraph, each executive agency may make appropriate allowance for any estimated loss in sales price resulting from the incorporation of use restrictions in the disposal documents.

(4) All executive agencies responsible for programs which entail land use planning shall take flood hazards into account when evaluating plans and shall encourage land use appropriate to the degree of hazard involved.

SEC. 2. As may be permitted by law, the head of each executive agency shall issue appropriate rules and regulations to govern the carrying out of the provisions of Section 1 of this order by his agency.

SEC. 3. Requests for flood hazard information may be addressed to the Secretary of the Army or, in the case of lands lying in the basin of the Tennessee River, to the Tennessee Valley Authority. The Secretary or the Tennessee Valley Authority shall provide such information as may be available, including requested guidance on flood proofing. The Department of Agriculture, Department of the Interior, Department of Commerce, Department of Housing and Urban Development, and Office of Emergency Planning, and any other executive agency which may have information and data relating to floods shall cooperate with the Secretary of the Army in providing such information and in developing procedures to process information requests.

SEC. 4. Any requests for appropriations for Federal construction of new buildings, structures, roads, or other facilities transmitted to the Bureau of the Budget by an executive agency shall be accompanied by a statement by the head of the agency on the findings of his agency's evaluation and consideration of flood hazards in the development of such requests.

SEC. 5. As used in this order, the term "executive agency" includes any department, establishment, corporation, or other organizational entity of the executive branch of the Government.

SEC. 6. The executive agencies shall proceed immediately to develop such procedures, regulations, and information as are provided for in, or may be necessary to carry out, the provisions of Sections 1, 2, and 3 of this order. In other respects this order shall take effect on January 1, 1967.

LYNDON B. JOHNSON

THE WHITE HOUSE,
August 10, 1966.

[F.R. Doc. 66-8838; Filed, Aug. 10, 1966; 12:14 p.m.]

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